

Rancho Seco Nuclear Generating Station

License Termination Plan



TABLE OF CONTENTS

1.0	GENERAL INFORMATION	1-1
1.1.	Purpose.....	1-1
1.2.	Scope.....	1-1
1.3.	Historical Background and Site Description.....	1-2
1.4.	Decommissioning Approach.....	1-3
1.5.	Plan Summary	1-5
1.6.	License Termination Plan Change Process.....	1-9
1.7.	License Termination Plan Information Contact.....	1-10
1.8.	References.....	1-10
2.0	SITE CHARACTERIZATION.....	2-1
2.1	Historical Site Assessment Summary	2-1
2.2	Hydrogeological Investigations	2-24
2.3	Pre-Characterization Scoping Surveys.....	2-35
2.4	Site Characterization Survey Methods.....	2-40
2.5	Summary of Initial Characterization Survey (ICS) Results.....	2-48
2.6	Continuing Characterization	2-58
2.7	Summary	2-58
2.8	References.....	2-91
3.0	IDENTIFICATION OF REMAINING DECOMMISSIONING ACTIVITIES	3-1
3.1	Introduction.....	3-1
3.2	Completed Decommissioning Activities and Tasks	3-2
3.3	Future Decommissioning Activities	3-7
3.4	Radiological Impacts of Decontamination and Dismantlement Activities	3-11
3.5	Site Description after License Release.....	3-14
3.6	Coordination with Outside Entities.....	3-14
3.7	References.....	3-16
4.0	SITE REMEDIATION PLAN	4-1
4.1	Remediation Actions and ALARA Evaluations	4-1
4.2	Remediation Actions.....	4-1
4.3	Remediation Activities Impact on the Radiation Protection Program	4-4
4.4	ALARA Evaluation	4-5
4.5	Unit Cost Estimates	4-9
4.6	Radionuclides Considered for ALARA Calculations	4-14
4.7	ALARA Calculation Results.....	4-15
4.8	References.....	4-15
5.0	FINAL STATUS SURVEY PLAN	5-1
5.1	Introduction.....	5-1
5.2	Development of Survey Plan	5-5
5.3	Survey Design and Data Quality Objectives.....	5-21

Rancho Seco License Termination Plan

Table of Contents

Revision 0

April 2006

5.4	Survey Methods and Instrumentation	5-31
5.5	Data Collection and Processing	5-46
5.6	Data Assessment and Compliance	5-48
5.7	Reporting Format	5-53
5.8	Final Status Survey Quality Program	5-54
5.9	References.....	5-62
6.0	COMPLIANCE WITH THE RADIOLOGICAL CRITERIA FOR LICENSE TERMINATION	6-1
6.1	Site Release Criteria.....	6-1
6.2	Site Conditions.....	6-1
6.3	Source Term Assumptions	6-2
6.4	Dose Modeling Considerations.....	6-5
6.5	Computational Model Used for Dose Calculations	6-9
6.6	Derived Concentration Guideline Levels (DCGLs).....	6-10
6.7	Derivation of Area Factors.....	6-35
6.8	Comparison of Alternative Exposure Scenarios for Impacted Area Soils	6-40
6.9	References.....	6-60
7.0	UPDATE OF SITE-SPECIFIC DECOMMISSIONING COSTS.....	7-1
7.1	Introduction.....	7-1
7.2	Decommissioning Cost Estimate	7-3
7.3	Decommissioning Funding Plan	7-6
7.4	References.....	7-9
8.0	SUPPLEMENT TO THE ENVIRONMENTAL REPORT	8-1
8.1	Summary	8-1
8.2	Introduction and Purpose	8-1
8.3	Site Description After Unrestricted Release	8-4
8.4	Impacts to the Post-Shutdown Decommissioning Activities Report	8-4
8.5	Rancho Seco Site Environmental Description	8-5
8.6	Environmental Effects Of Decommissioning	8-15
8.7	Overview Of Regulations Governing Decommissioning Activities and Site Release.....	8-24
8.8	REFERENCES	8-31

TABLES

2-1	Personnel Observations Summary	2-5
2-2	Operational History Summary	2-7
2-3	Discharge Canal Sediment	2-12
2-4	Depression Area Soil Vendor Laboratory Results	2-14
2-5	Area Designations	2-24
2-6	Well Construction and Water Elevation Data	2-26
2-7	General Minerals Results from Analyses of Groundwater	2-31

Rancho Seco License Termination Plan

Table of Contents

Revision 0

April 2006

2.8	Groundwater Monitoring Radiochemical Results.....	2-34
2-9	Effect of Temporal Variability.....	2-38
2-10	Effect of Spatial Variability	2-39
2-11	Gross Activity Variability Due to Plant Operations	2-40
2-12	Cs-137 Variability Due to Plant Operations	2-40
2-13	Typical On-Site Characterization Detection Sensitivities.....	2-42
2-14	Vendor Laboratory Standard MDA Values	2-43
2-15	Specific Soil Contamination Investigation Locations.....	2-46
2-16	Concrete Structure Nuclide Fraction	2-47
2-17	Site Structures Below the DCGL.....	2-48
2-18	Special Area Locations	2-49
2-19	Activated Nuclide Fractions For Bioshield Concrete and Rebar	2-50
2-20	Embedded Pipe Gamma- Emitting Nuclide Fractions	2-51
2-21	Embedded Piping Systems.....	2-52
2-22	Buried Piping Nuclide Fractions and Ratio To Cs-137	2-53
2-23	Buried Piping Systems.....	2-53
2-24	Non-Impacted Systems	2-54
2-25	Impacted Soil Area Characterization Results	2-54
2-26	Soil Nuclide Fractions.....	2-55
2-27	Spent Fuel Cooler Pad Residual Soil Concentrations Comparison To NRC/ORISE Results ...	2-55
2-28	Spent Fuel Pool Subsoil Residual Soil Concentrations, NRC/ORISE Results	2-56
3-1	Schedule of Remaining Major Activities.....	3-7
3-2	Solid Waste Effluent Release Report Summary	3-12
3-3	Liquid Waste Effluent Releases.....	3-13
3-4	Gaseous Waste Effluent Releases	3-14
4-1	Acceptable Parameter Values for Use in ALARA Analyses	4-11
4-2	ALARA Evaluation Results.....	4-15
5-1	Single Nuclide DCGLW Values for Detectable Radionuclides in Soil.....	5-6
5-2	Calculated Structural Surface Single Nuclide DCFs and DCGL _{WS}	5-7
5-3	Area Designations	5-11
5-4A	Survey Unit Classifications – General Open Land Areas.....	5-12
5-4B	Survey Unit Classifications - Site Surface Soils	5-13
5-4C	Survey Unit Classification – Paved Surfaces and Foundation Pads	5-14
5-4D	Survey Area Characterization-Structures.....	5-16
5-4E	Survey Area Characterization – Remaining Buried and Embedded Pipe	5-18
5-5	Suggested Survey Unit Areas	5-19
5-6	Scan Measurements	5-22
5-7	Investigation Levels	5-27
5-8	Calculated Surface Soil Area Factors	5-28
5-9	Calculated Structural Surface Area Factor Values	5-29
5-10	Investigation Actions for Individual Survey Unit Measurements.....	5-30

5-11	Typical FSS Survey Instrumentation	5-36
5-12	Typical FSS Detection Sensitivities.....	5-38
5-13	Interpretation of Sample Measurements When the WRS Test Is Used	5-48
5-14	Interpretation of Sample Measurements When the Sign Test Is Used.....	5-49
6-1	Site-Specific Suite of Radionuclides for Use at Rancho Seco	6-5
6-2	Sensitivity Analysis Radionuclide Concentrations	6-14
6-3	Potential Parameter Correlations	6-15
6-4	Discounted Radionuclide Concentrations for Dose Evaluation.....	6-17
6-5	Single Nuclide DCGL Values for Detectable Radionuclides	6-18
6-6	Maximum Allowable Radionuclide Mixture Concentrations	6-20
6-7	Peak of the Mean Dose vs Contaminated Layer Thickness.....	6-20
6-8	Peak of the Mean Dose vs Discrete Contamination Pocket Depth	6-21
6-9	Calculated Structural Surface Single Nuclide DCFs and DCGLs	6-24
6-10	Bulk Material Single Nuclide DCF and DCGL Values	6-27
6-11	Containment Building Surface Single Nuclide DCF and DCGL Values for the Industrial Worker Building Inspection Scenario	6-30
6-12	Containment Building Surface Single Nuclide DCF and DCGL Values – Renovation/Demolition Scenario	6-32
6-13	Embedded Pipe Annual Dose Rate By Building	6-34
6-14	Single Nuclide DCGL Values for Detectable Radionuclides	6-36
6-15	Calculated Peak-of-the-Mean DSR Values.....	6-37
6-16	Calculated Surface Soil Area Factors	6-38
6-17	Calculated Mean DSR Values for Structural Surface Area Factors	6-39
6-18	Calculated Surface Area Factor Values	6-40
6-19	Calculated Dose Using a Resident Farmer Scenario	6-44
7-1	Summary of Remaining Decommissioning Costs in Year 2005 Dollars.....	7-6
8-1	Projected Population Growth	8-6
8-2	Expected Extreme Wind Speeds	8-9
8-3	Precipitation Climatology	8-10
8-4	Precipitation Intensity	8-10

FIGURES

2-1	Rancho Seco Industrial Area Map	2-60
2-2	Impacted Area.....	2-61
2-3	Area Designations.....	2-62
2-4	Locations of Borings Drilled and Sampled at Rancho Seco	2-63
2-5	Potentiometric Surface Map for Groundwater Beneath Rancho Seco, December 2005	2-64
2-6	Piper Diagram for Groundwater Concentrations Beneath Rancho Seco	2-65
2-7	Stiff Diagrams of Cation and Anion Concentrations in Groundwater Beneath and Upgradient from Ranch Seco	2-65

Rancho Seco License Termination Plan

Table of Contents

Revision 0

April 2006

2-8	Spent Fuel Cooler Pad Soil Characterization Locations	2-66
2-9	Tank Farm Soil Characterization Locations, 810001 and 810002.....	2-67
2-10	Spent Fuel Building-Diesel Generator Room Gap Soil Characterization Location, 826000.....	2-68
2-11	Effluent Water Course Soil Characterization Locations, 100001	2-69
2-12	RHUT Area Soil Characterization Locations, 837000	2-70
2-13	Old Bechtel Building Soil Characterization Locations, 800004	2-71
2-14	Auxiliary Building -20' and -29' El. Concrete Characterization Sample Locations, 813000	2-72
2-15	Auxiliary Building -47' El. Concrete Characterization Sample Locations, 813000	2-73
2-16	Fuel Storage Building Concrete Characterization Sample Locations, 812000	2-74
2-17	Reactor Building 40' El Concrete Characterization Sample Locations, 811000	2-75
2-18	Reactor Building 0' El. Concrete Characterization Locations, 811000	2-76
2-19	Reactor Building -27' El. Concrete Characterization Locations, 811000	2-77
2-20	Turbine Building -10' El. Concrete Characterization Locations, 826000.....	2-78
2-21	Turbine Building 0' El. Concrete Characterization Locations, 826000.....	2-79
2-22	Reactor Building Activated Concrete Characterization Locations, 811000	2-80
2-23	Activation Depth Associated with Each Core at the Respective Elevations.....	2-81
2-24	Eu-152 Concentration for the Mid-Core Region	2-81
2-25	Turbine Building Grade Level Drains, 826000	2-82
2-26	Turbine Building 40' El. Drains, 826000	2-83
2-27	Auxiliary Building -20'El. Drains.....	2-84
2-28	Auxiliary Building -47' El. Drains.....	2-85
2-29	Spent Fuel Pool Drains	2-86
2-29a	Spent Fuel Pool Drains 0' Elevation.....	2-87
2-30	Reactor Building Drains -27 El.....	2-88
3-31	Fuel Storage Building Soil	2-89
3-1	Dose-Estimate and Actual (Person-Rem)	3-15
5-1	FSS Process Overview	5-60
5-2	Area Designations	5-61
6-1	Rancho Seco Reservoir and Recreation Area	6-46
6-2	Rancho Seco Switchyard and ISFSI	6-47
6-3	Rancho Seco Photovoltaic Generating Facility	6-48
6-4	Aerial Photograph of the Combined Cycle Cosumnes Power Plant	6-49
6-5	RESRAD Parameter Selection Process.....	6-50
6-6	Peak of the Mean Dose vs Contaminated Layer Thickness for Principal Dose Contributors	6-51
6-7	Peak of the Mean Dose vs Contaminated Layer Thickness for Minor Dose Contributors.....	6-52
6-8	Peak of the Peak of the Mean Dose vs Discrete Contamination Pocket Depth	6-53
6-9	Time of the Peak of the Mean Dose vs Discrete Contamination Pocket Depth.....	6-54
6-10	RESRAD-BUILD Parameter Selection Process	6-55
6-11	Surface Soil Area Factors for Gamma Emitters.....	6-56
6-12	Surface Soil Area Factors for Beta Emitters.....	6-57
6-13	Structural Surface Area Factors	6-58

6-14	Calculated Dose Using a Resident Farmer Scenario	6-59
7-1	Summary of Remaining Decommissioning Costs in Year 2005 Dollars.....	7-8
8-1	Rancho Seco Site Map	8-27
8-2	Wind Roses	8-29
8-3	Yearly Wind Roses	8-30
8-4	Ground Water Contour Map	8-31

APPENDICES

2-A	Miscellaneous Historical Construction Photographs	2-93
2-B	Site and Structure Drawings With Sample and Survey Locations.....	2-111
4-A	Unit Cost Values	4-17
6-A	RESRAD Parameters for Soil Dose Modeling Probabilistic Analysis	6-63
6-B	RESRAD Sensitivity Analysis Distribution Parameters.....	6-79
6-C	RESRAD Distribution Parameter Sensitivity Analysis Results.....	6-83
6-D	RESRAD Parameters for Probabilistic Analysis of Discounted Radionuclides	6-85
6-E	Distribution Parameters and Sensitivity Analysis Results for Discounted Radionuclides	6-111
6-F	Parameters for Probabilistic Analysis of Varying Contamination Layer Thickness	6-123
6-G	Dose Modeling Distribution Parameters – Industrial Worker Scenario	6-139
6-H	Parameters for Probabilistic Analysis of Discrete Pockets of Contamination	6-143
6-I	Distribution Parameters for Analysis of Discrete Pockets of Contamination	6-159
6-J	RESRAD-BUILD Parameters for Rancho Seco Structural Surfaces Sensitivity Analysis	6-163
6-K	Sensitivity Analysis Distribution Parameters and Sensitive Parameter Results	6-173
6-L	Radionuclide Specific RESRAD-BUILD Sensitive Parameters.....	6-175
6-M	Parameters for Rancho Seco Structural Surfaces DCGL Derivation.....	6-179
6-N	Parameters for Rancho Seco Bulk Material Sensitivity Analysis.....	6-191
6-O	Distribution Parameters for Analysis of Bulk Material and Sensitive Parameter Results	6-197
6-P	RESRAD-BUILD Input Parameters for Derivation of Containment Inspection Single Nuclide DCFs	6-199
6-Q	Parameters for Containment Building DCGL Sensitivity Analysis.....	6-213
6-R	Statistical Distribution Parameters and Sensitive Parameter Results for Containment Building DCGLs	6-227
6-S	Parameters for Surface Soil Area Factor Dose Modeling Probabilistic Analysis.....	6-233
6-T	Surface Soil Area Factor Dose Modeling Distribution Parameters	6-249
6-U	Parameters for Structural Surface Area Factor Derivation	6-253
6-V	Distribution Parameters for Structural Surface Area Factor Derivation	6-259
6-W	Parameters for Sensitivity Analysis of Detected Radionuclides – Resident Farmer Scenario	6-261
6-X	Sensitivity Analysis Distribution Parameters and Sensitive Parameter Results for Detected Radionuclides - Resident Farmer Scenario	6-279
6-Y	Parameters for Sensitivity Analysis of Discounted Radionuclides, Resident Farmer Scenario	6-283

Rancho Seco License Termination Plan
Table of Contents

Revision 0
April 2006

6-Z	Distribution Parameters and Sensitive Parameter Results for Discounted Radionuclides, Resident Farmer Scenario	6-319
-----	---	-------

This page intentionally left blank